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The Resources Agency
DEPARTMENT OF FISH AND GAME

STANDING STOCKS OF FISHES IN SECTIONS OF BIG GRIZZLY CREEK PLUMAS COUNTY, 1995

by

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INTRODUCTION

The Department of Water Resources (DWR) initiated an instream flow program in 1976 to identify streams that would benefit from flow enhancement, to assess instream values, and identify actions such as habitat manipulation that could enhance these streams. The Northern District of the DWR selected Big Grizzly Creek below Lake Davis (Figure 1) as one of the streams to study under this program.

Previous sampling effort on Big Grizzly Creek has been conducted by Department of Fish and Game (DFG) biologists. Initial estimates of rainbow trout (Oncorhynchus mykiss) populations were made by the DFG in 1976 (Brown 1976). The DFG also surveyed the creek in 1981, 1986, 1988, 1991, 1994, and 1995 to estimate standing stocks of brown trout (Salmo trutta) and rainbow trout in selected stations (Bumpass et al. 1989, Brown 1991a, Brown 1991b, Brown 1992, and Brown 1995).

The objective of this study is to estimate the number, age, and growth of trout in stations established in 1976. The stations were originally established to set baseline conditions with which future changes in seasonal stream flow or other elements of habitat would be compared. A report discussing twenty-five years of fisheries studies on Big Grizzly Creek is scheduled to be prepared in the year 2001.

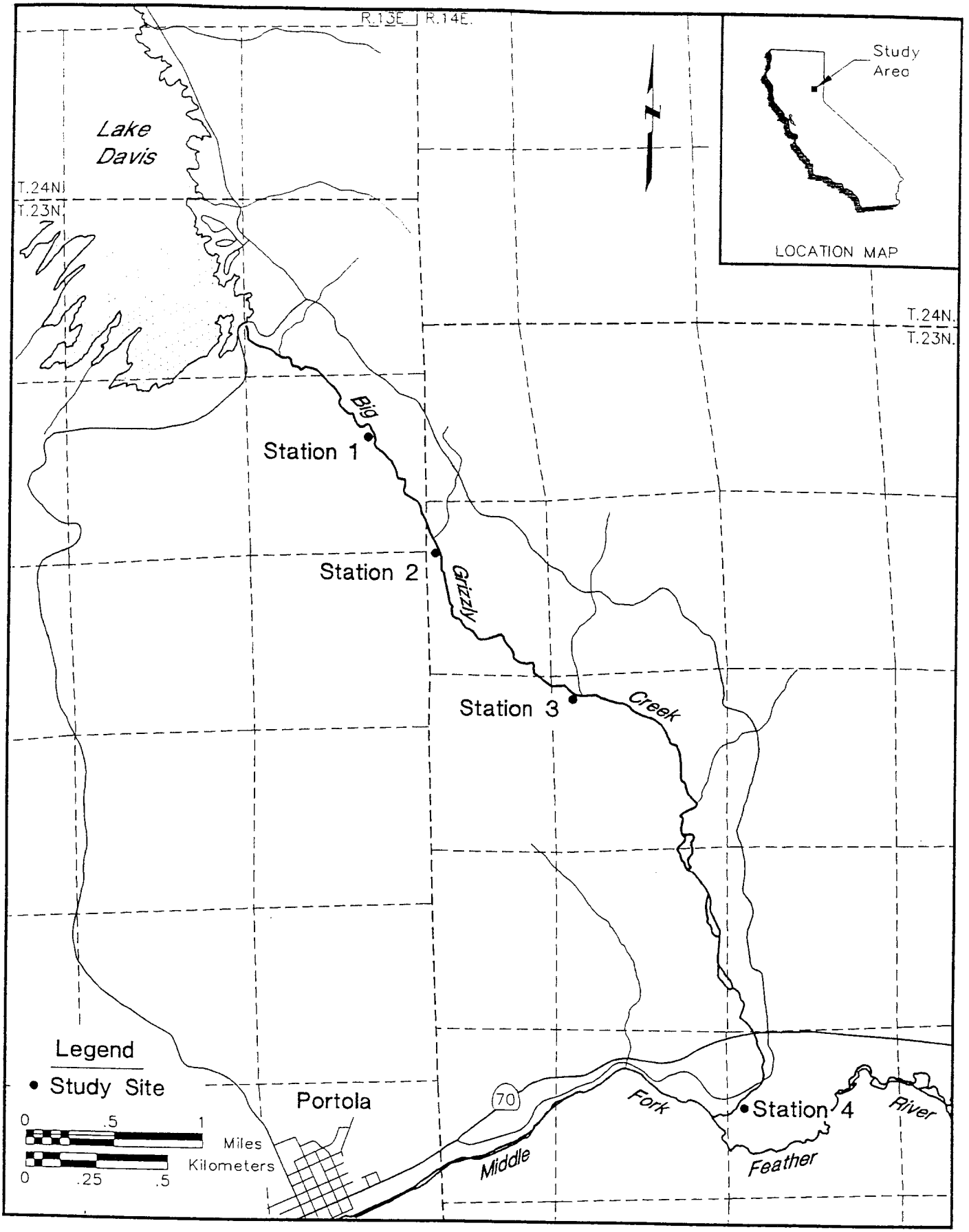

Figure 1. Stations sampled to estimate standing crop of trout in Big Grizzly Creek, Plumas County, 1995.

NAMES OF FISHES

The following species of fishes were caught in this study: rainbow trout, brown trout, and Sacramento sucker (Catostomus occidentalis).

METHODS

Physical Measurements

Standing stocks of fishes were estimated at four stations in Big Grizzly Creek (Figure 1). Stations were intentionally selected to be near stations sampled in previous DFG studies (Gerstung 1973). Markers had previously been placed in trees along the stream to identify station boundaries. Stations varied in length from 45.7 to 91.4 m (Appendix 1). The length and width of each station was measured with metric tape measures.

Biological Measurements

Fish were captured with a battery-powered backpack electroshocker in stream sections blocked by seines as described by Platts et al. (1983). Captured fish were removed from the net-enclosed section on each pass. Standing stock estimates were developed using the two-count method of Seber and LeCren (1967) or the multiple-pass method of Leslie and Davis (1939) with limits of confidence computed using a formula proposed by DeLury (1951).

The weights of trout were measured by displacement. Fork length (FL) of each fish caught was measured to the nearest millimeter.

Scale samples were taken from brown trout and rainbow trout over 100 mm in length. Scales were taken just above the lateral line between the dorsal and adipose fin (Scarnecchia 1979) and placed in a piece of paper inserted in a small coin envelope (Drummond 1966). Scales were mounted dry between microscope slides, and their images were projected on a NCR microfiche reader at a magnification of 42x. Scale measurements for the calculation of growth were recorded to the nearest millimeter along the anterior radius of the anterior-posterior axis of the scale. Estimation of instantaneous population growth rate was calculated (Ricker 1975) with significant values of correlation coefficients taken from a table (Steel and Torrie 1960).

Instantaneous population growth rate = $b(\log_e l_2 - \log_e l_1)$

b = between ages functional slope
l_1 = initial length for the last complete year of growth
l_2 = final length for the last complete year of growth

Standing crops of brown trout and rainbow trout were calculated for individual stations where each species was caught and then combined for the entire creek. Age and growth were calculated for the population (Everhart et al. 1975). Length-weight relationships were determined for both brown trout and rainbow trout (Lagler 1956). The coefficient of condition and 95 percent confidence intervals were calculated for all trout (Carlander 1969). Distribution of all fish caught is listed according to location.

RESULTS

Distribution

Rainbow trout were caught in each station. Brown trout, rainbow trout, and Sacramento suckers were caught in station 4, the lowest station sampled (Table 1).

TABLE 1. Distribution of fishes in sections of Big Grizzly Creek, Plumas County, 1995.

	Station Number			
	1	2	3	4
Distance below Grizzly Valley Dam (km)	2.5	3.2	4.8	9.7
Brown trout				X
Rainbow trout	X	X	X	X
Sacramento sucker				X

Standing Crop

Rainbow trout was the most common game fish caught in Big Grizzly Creek. Biomass averaged 1.0 g/m^2 in four stations (Table 2). Catchable rainbow trout ($\geq$127 mm FL) biomass averaged 0.9 g/m^2. We found brown trout in only one station. Biomass in that station was 2.0 g/m^2 (Table 3). Catchable brown trout biomass was 1.8 g/m^2. Biomass was not estimated for Sacramento suckers.

Table 2. Estimate of rainbow trout standing crop in Big Grizzly Creek, Plumas County, 1995.

Distance Below Grizzly Valley Dam (km)	Population Estimate	95% Confidence Interval	Biomass (g/m^2)	Estimate of Catchable Trout ($\geq$ 127 mm FL)	Biomass of Catchable Trout (g/m^2)
2.5	12	12-13	0.8	10	0.7
3.2	22	20-29	2.0	15	1.9
4.8	12	12-14	0.7	11	0.7
9.7	20	20-22	0.6	6	0.5

Table 3. Estimate of brown trout standing crop in Big Grizzly Creek, Plumas County, 1995.

Distance Below Grizzly Valley Dam (km)	Population Estimate	95% Confidence Interval	Biomass (g/m^2)	Estimate of Catchable Trout ($\geq$ 127 mm FL)	Biomass of Catchable Trout (g/m^2)
9.7	32	29-39	2.0	19	1.8

Length and Weight

Age group 0+ rainbow trout represented 33 percent of the 64 rainbow trout caught. Ages 1+ and 2+ comprised 49 percent and 18 percent respectively (Figure 2 and Appendix 2). Age group 0+ brown trout made up 18 percent of the 29 brown trout caught. Ages 1+ and 2+ comprised 47 percent and 28 percent respectively. Age 3+ brown trout made up 7 percent of the catch. (Figure 3 and Appendix 3).

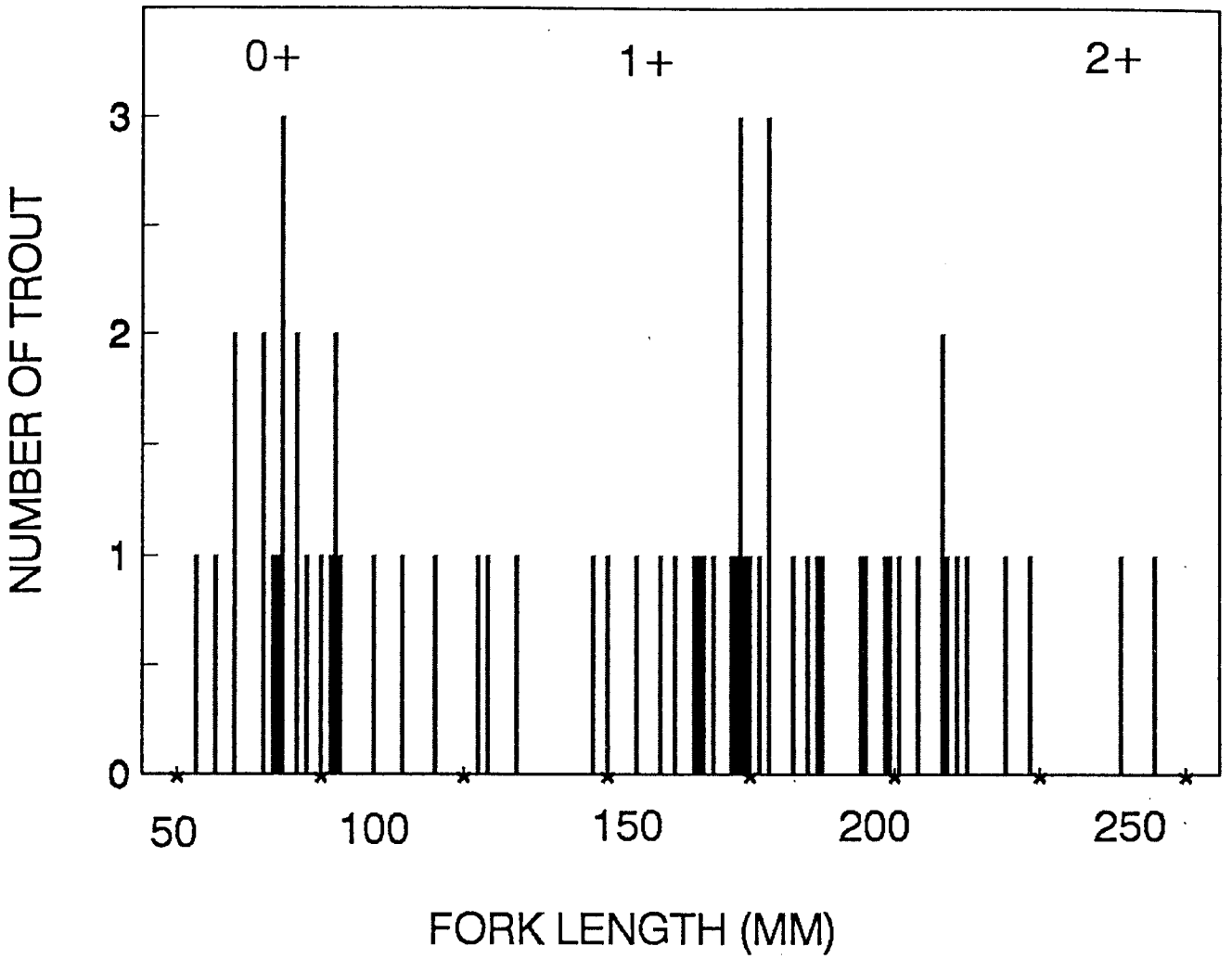

FIGURE 2. Length, observed frequency, and age of rainbow trout caught in Big Grizzly Creek, Plumas County, 1995

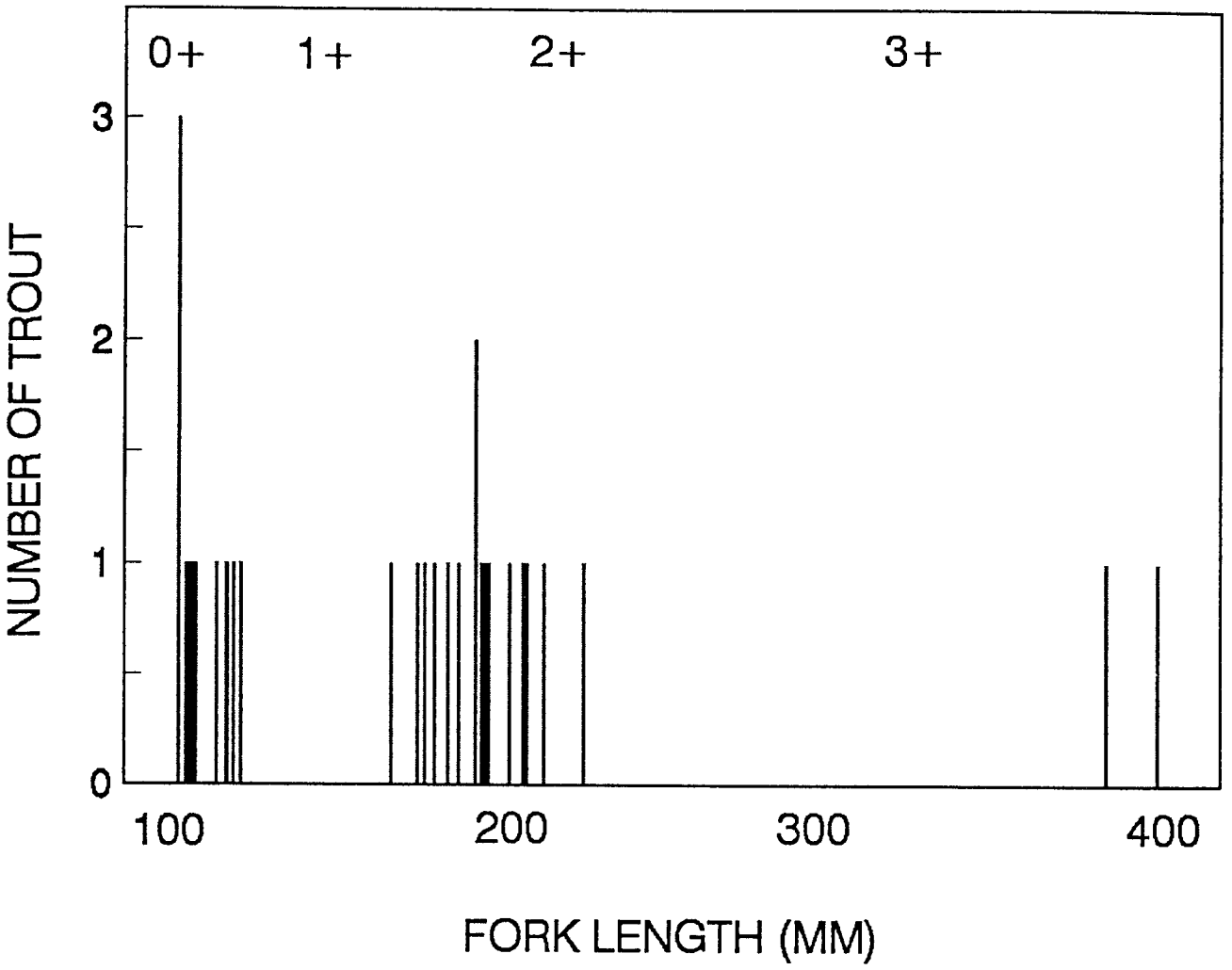

FIGURE 3. Length, observed frequency, and age of brown trout caught in Big Grizzly Creek, Plumas County, 1995

The relationship between fork length and weight (W) of rainbow trout for Big Grizzly Creek is:

$$\text{Log}_{10}W = -4.5 + 2.8\ \text{Log}_{10}FL$$

$$r^2 = 0.99$$

$$N = 64$$ (Figure 4 and Appendix 4)

The same relationship for brown trout is:

$$\text{Log}_{10}W = -4.8 + 3.0\ \text{Log}_{10}FL$$

$$r^2 = 0.99$$

$$N = 29$$ (Figure 5 and Appendix 5)

Age and Growth

The formula FL = 8.6 + 0.1 S describes the relationship between the fork length and enlarged scale radius (S) of 38 rainbow trout caught in Big Grizzly Creek. The coefficient of correlation (r^2) is 0.54. The formula was FL = 7.5 + 0.1 S for 7 brown trout, while the value for r^2 is 0.84.

Population growth and mean individual growth were greater for brown trout than rainbow trout (tables 5 and 6).

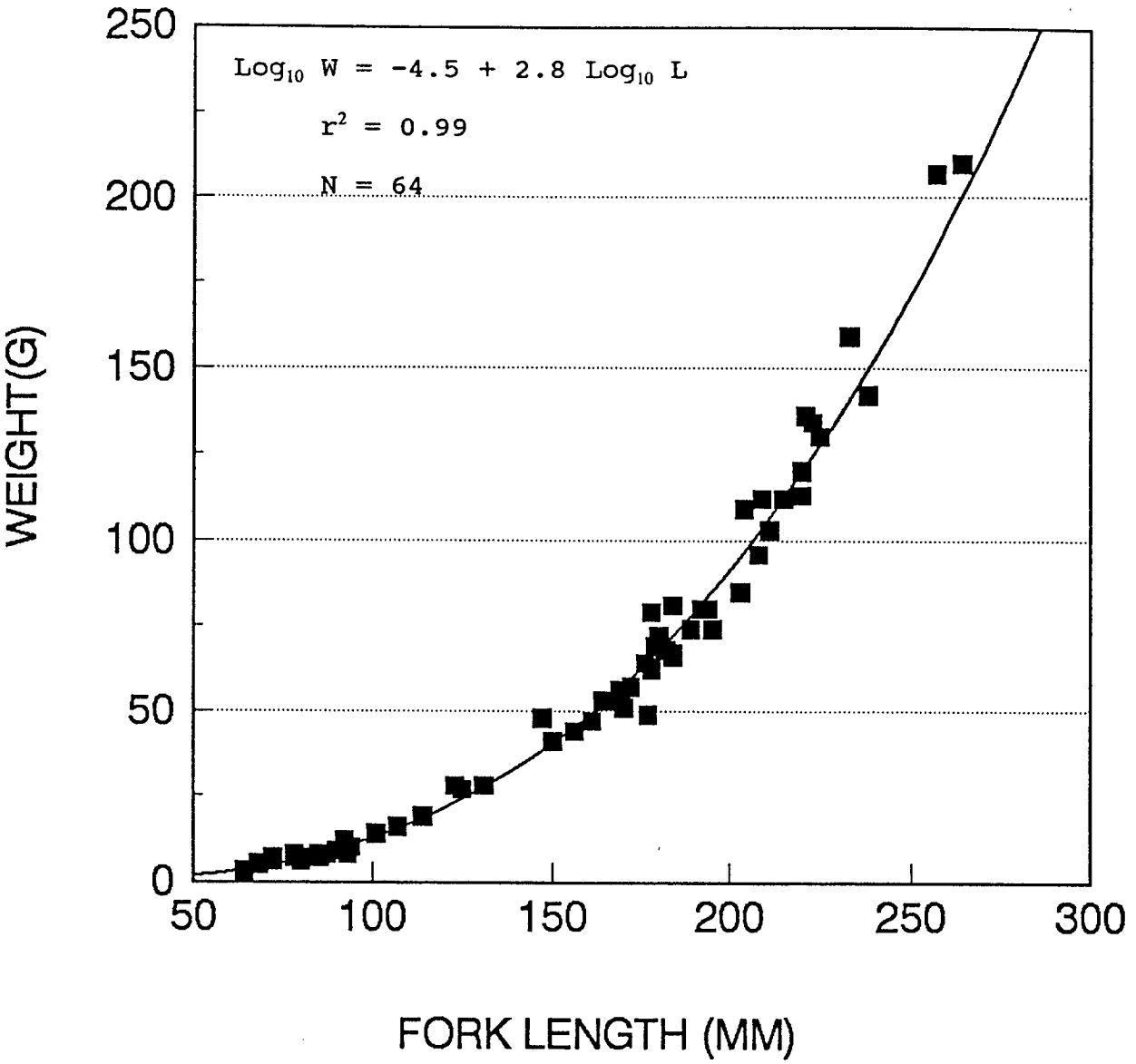

FIGURE 4. The relationship between length and weight of rainbow trout caught in sections of Big Grizzly Creek, Plumas County, 1995.

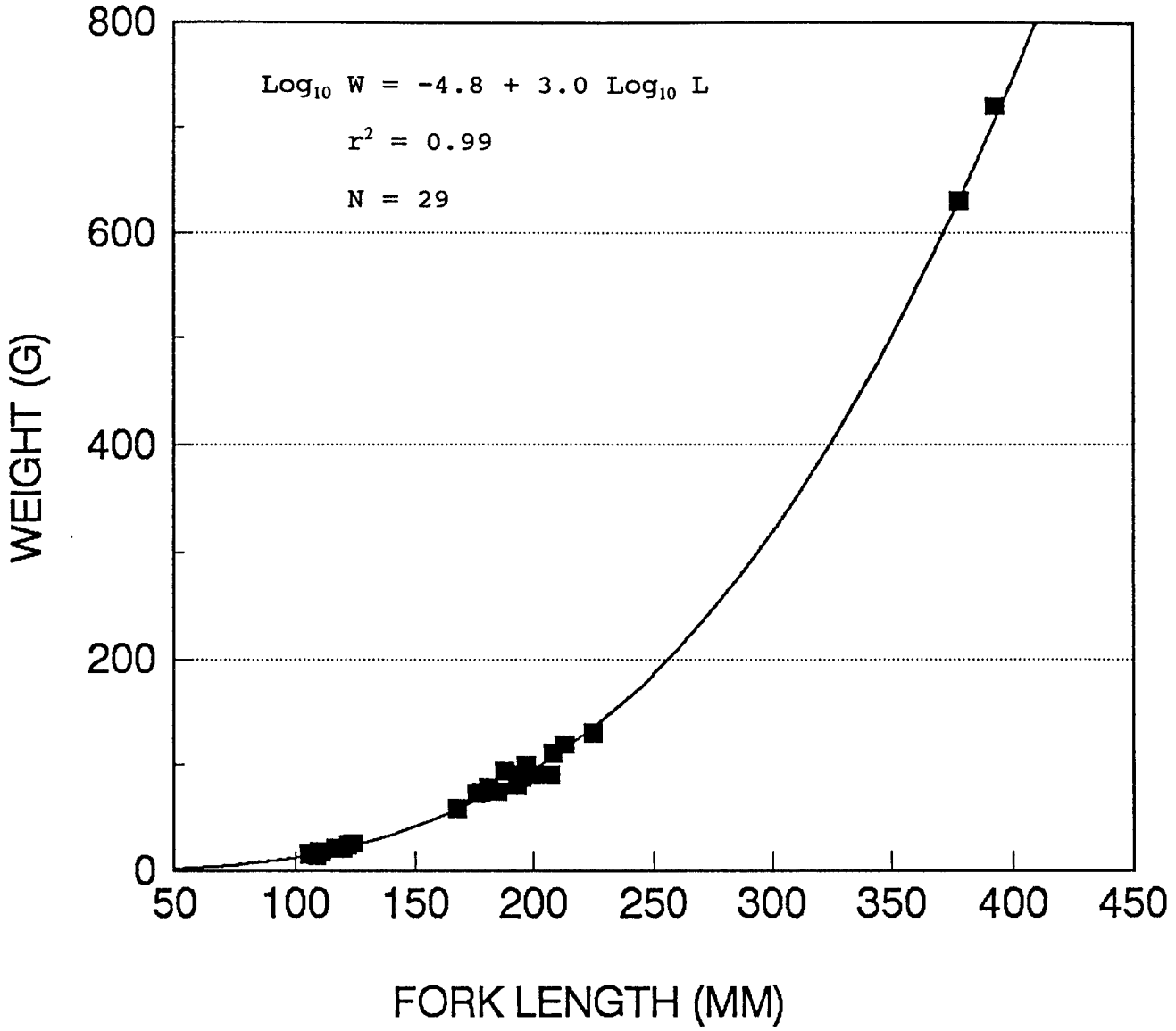

FIGURE 5. The relationship between length and weight of brown trout caught in sections of Big Grizzly Creek, Plumas County, 1995

Table 5. Growth rates for rainbow trout caught in Big Grizzly Creek, 1995.

	Population Growth			Mean Individual Growth		
Age	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx
1-2	86-190	0.793	2.219	97-190	0.672	1.882

Table 6. Growth rates for brown trout caught in Big Grizzly Creek, 1995.

	Population Growth			Mean Individual Growth		
Age	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx
1-2	81-182	0.810	2.429	88-182	0.727	2.180

Age 1+ rainbow trout averaged 166 mm fork length and age 2+ rainbow trout averaged 226 mm fork length (Table 7). Age 1+ and age 2+ brown trout averaged 135 mm and 197 mm, respectively (Table 8).

Table 7. Calculated fork length of rainbow trout from Big Grizzly Creek, 1995.

Age	Number of Fish	Length at Capture	Length at Successive Annulus 1	2
1	32	166	86	
2	12	226	97	190
Number of back-calculations			44	12
Weighted means (mm)			89	190
Increments (mm)				101

Table 8. Calculated fork length of brown trout from Big Grizzly Creek, 1995.

Age	Number of Fish	Length at Capture	Length at Successive Annulus 1	2
1	11	135	81	
2	12	197	88	182
Number of back-calculations			23	12
Weighted means (mm)			85	182
Increments (mm)				97

Coefficient of Condition

The average coefficient of condition for 64 rainbow trout was 1.2256 and 1.2225 for 29 brown trout. Age 0+ rainbow trout had slightly higher coefficients of condition than brown trout of the same age group (Table 9).

Table 9. Condition of rainbow trout and brown trout in Big Grizzly Creek, Plumas County, 1995.

Age Group	Number of Fish	Coefficient of Condition	95% Confidence Interval
Rainbow trout			
0+	21	1.3377	0.9326-1.7518
1+	32	1.1767	0.9085-1.4448
2+	11	1.1538	1.0179-1.2898
Combined	64	1.2256	0.8803-1.5709
Brown trout			
0+	5	1.2100	1.0733-1.3467
1+	14	1.2484	1.0931-1.4037
2+	8	1.1700	1.0033-1.3367
3+	2	1.2823	0.8327-1.7319
Combined	29	1.2181	1.0486-1.3875

DISCUSSION

Summer streamflow in Big Grizzly Creek has generally been between 0.6 and 0.3 cms from 1974 to 1993. Higher flows occurred in 1977 and 1979 (Table 10). Haines (1982) reported that optimum flows for rainbow trout was 0.6 cms. Her recommendation was based on an instream flow study that the DWR conducted in 1981. The DWR bases flow releases from Lake Davis on lake water levels in the spring. Lake water levels were low from 1988 through 1994 so minimum releases (0.3 cms) were the rule.

Table 10. Average summer streamflow in Big Grizzly Creek, 1974-1995.

Year	Flow (cms)	Year	Flow (cms)
1974	0.7	1985	0.5
1975	0.4	1986	0.6
1976	0.3	1987	0.5
1977	1.8	1988	0.3
1978	0.3	1989	0.3
1979	2.2	1990	0.3
1980	0.4	1991	0.3
1981	0.3	1992	0.3
1982	0.6	1993	0.3
1983	0.6	1994	0.3
1984	0.6	1995	0.6

Biomass of rainbow trout has averaged 2.6 g\m^2 and ranged from 0 to 5.6 g\m^2 since we began sampling in 1976 (Table 11). There is no significant correlation between streamflow and biomass ($r^2 = 0.03$) because rainbow trout biomass was lower in 1986 than we expected from the relative high summer flows that were released that year. Brown trout biomass has averaged 3.7 g/m^2 and ranged from 0 to 15.3 g/m^2 at station 4. No brown trout has been caught in stations 1 through 3. Brown trout biomass is not correlated with flow ($p > 0.05$)

Table 11. Biomass (g/m^2) of rainbow and brown trout in Big Grizzly Creek.

Year	Rainbow trout	Brown trout
1976	1.9	-
1981	1.8	0.5
1986	3.2	15.3
1988	5.6	1.7
1994	2.2	2.6
1995	1.0	2.0

Estimated numbers of catchable-size rainbow trout were slightly below average since we began sampling Big Grizzly Creek in 1981 (Table 12). Catchable-size rainbow trout averaged 0.04 trout/m^2 and catchable-size brown trout averaged 0.03 trout/m^2. Low numbers of both species of trout in 1995 were probably a result of prolonged periods of low flow in Big Grizzly Creek (Table 10). We found a strong correlation between streamflow and numbers of catchable-size rainbow and brown trout in Indian Creek (Brown 1993).

Table 12. Density of catchable-size rainbow and brown trout (trout/m^2) in Big Grizzly Creek.

Year	Rainbow trout	Brown trout
1981	0.01	0
1986	0.04	0.08
1988	0.09	0.02
1994	0.02	0.02
1995	0.03	0.01

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APPENDIX 1

PERMANENT FISH POPULATION STATIONS FOR
BIG GRIZZLY CREEK, PLUMAS COUNTY
SEPTEMBER, 1995

Station 1 (Stream Gage Station) - Station 1 is located 2.5 stream km below Grizzly Valley Dam and just downstream from an abandoned USGS stream gage at an elevation of 1622 m MSL. The station is located 21 m downstream from the concrete weir of the stream gage (UTM 170 167). The stream within the station is a steep rapid area (67%) with several split channels and small pocket pools that ends in a long, shallow pool (33%). It is 45.7 m long and has a surface area of 347.3 m^2 at 0.56 cms. Substrate is 75% boulders, 15% rubble, and 10% sand.

Station 2 (IFN Station) - Station 2 is 3.2 stream km below Grizzly Valley Dam. The site located at UTM 176 156 at an elevation of 1610 m MSL. The upper end of the station is a steep rapid (55%) followed by two deep pools (45%) separated by short rapids. The substrate is mostly rubble (60%), boulder (20%), gravel (10%), with areas of sand (10%) in the pools. The station is 46.3 m long with a surface area of 222.2 m^2 at 0.56 cms.

Station 3 (3-Mile Station) - Station 3 is located 4.8 km downstream from Grizzly Valley Dam at an elevation of 1549 m MSL at UTM 189 141. The station begins in a steep rapid followed by more gradual rapids (75%) with pocket pools and two larger pools (25%) near the lower end. Substrate is boulder (65%), rubble (20%), sand (10%), and gravel (5%). The station is 55.2 m long and has a surface area of 358.8 m^2 at 0.56 cms.

Station 4 (6-Mile Station) - Station 4 is located 9.7 km below Grizzly Valley Dam and 0.2 km above the confluence with the Middle Fork Feather River at an elevation of 1488 m MSL. It is located at UTM 205 106. The station begins in a rapid just above a large 0.7 m deep pool (33%) followed by several riffle areas (67%) and shallow pools with undercut banks and overhanging grass clumps. Substrate is rubble (10%), gravel (75%), bedrock (10%), and mud (5%). The station is 91.4 m long with a surface area of 484.4 m^2 at 0.56 cms.

APPENDIX 2

LENGTH AND NUMBER OF RAINBOW TROUT
CAUGHT IN BIG GRIZZLY CREEK, 1995

Fork Length (mm)	Weight (g)	Fork Length (mm)	Weight (g)	Fork Length (mm)	Weight (g)	Fork Length (mm)	Weight (g)
64	3	93	8	170	51	203	85
68	5	93	9	172	57	204	109
72	6	94	10	176	64	208	96
72	7	101	14	177	49	209	112
78	8	107	16	178	63	211	103
78	7	114	19	178	62	215	112
80	6	123	28	178	69	220	113
81	7	125	27	180	72	220	120
82	7	131	28	182	68	221	136
82	7	147	48	184	66	223	134
82	7	150	41	184	67	225	130
85	8	156	44	184	81	233	159
85	7	161	47	189	74	238	142
87	8	164	53	192	80	257	207
90	9	168	53	194	80	264	210
92	12	169	56	195	74		

APPENDIX 3

LENGTH AND NUMBER OF BROWN TROUT CAUGHT IN BIG GRIZZLY CREEK, 1995

Fork Length (mm)	Weight (g)	Fork Length (mm)	Weight (g)
106	15	185	74
106	15	185	94
106	15	193	80
108	15	193	82
109	14	195	87
110	17	196	90
111	17	197	99
117	20	203	90
120	20	207	90
122	23	208	111
124	25	213	119
168	58	225	130
176	72	378	630
178	73	393	720
181	77		